

7e

<b>Notice of Allowability</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	09/850,203	SAITO ET AL.	
	Examiner	Art Unit	
	Tracy Dov	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTO-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1.  This communication is responsive to 10/25/04.
2.  The allowed claim(s) is/are 2-5, 11 and 12.
3.  The drawings filed on 08 May 2001 are accepted by the Examiner.
4.  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a)  All
  - b)  Some\*
  - c)  None
 of the:
  1.  Certified copies of the priority documents have been received.
  2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3.  Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5.  A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6.  CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
  - (a)  including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
    - 1)  hereto or 2)  to Paper No./Mail Date \_\_\_\_\_.
  - (b)  including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7.  DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

#### Attachment(s)

1.  Notice of References Cited (PTO-892)
2.  Notice of Draftsperson's Patent Drawing Review (PTO-948)
3.  Information Disclosure Statements (PTO-1449 or PTO/SB/08),  
Paper No./Mail Date \_\_\_\_\_
4.  Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5.  Notice of Informal Patent Application (PTO-152)
6.  Interview Summary (PTO-413),  
Paper No./Mail Date attached.
7.  Examiner's Amendment/Comment
8.  Examiner's Statement of Reasons for Allowance
9.  Other \_\_\_\_\_.

### **EXAMINER'S AMENDMENT**

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Murat Ozgu on 1/5/05.

The application has been amended as follows:

Cancel claims 6-10.

Amend claim 2 as follows:

2. (Currently Amended) A fuel cell comprising a tubular casing, an electrolyte layer received in said tubular casing, a first gas diffusion electrode completely defining a fuel gas passage and a second gas diffusion electrode completely defining an oxidizing gas passage, wherein said first and second gas diffusion electrodes interpose said electrolyte layer, wherein: said first and second gas diffusion electrodes each comprise a plurality of layers of material stacked in the axial direction of said tubular casing, wherein said fuel and oxidizing gas passages, which extend in the axial direction, each have a non-uniform diameter and said first gas diffusion electrode extends continuously along said fuel gas passage; and, said second gas diffusion electrode extends continuously along said oxidizing gas passage.

### ***Allowable Subject Matter***

Claims 2-5, 11 and 12 are allowed.

The following is an examiner's statement of reasons for allowance: the claims are directed toward a tubular fuel cell comprising an electrolyte layer and a pair of gas diffusion electrodes interposing the electrolyte layer. The pair of gas diffusion electrodes includes a first gas diffusion electrode completely defining a fuel gas passage and a second gas diffusion electrode completely defining an oxidizing gas passage. Each gas diffusion electrode layer includes a plurality of layers of material stacked in the axial direction wherein each gas passage has a non-uniform diameter. Each gas diffusion electrode extends continuously along its associated gas passage.

The prior art does not teach the claimed invention. Lawless 6,372,375 teaches a honeycomb ceramic fuel cell (tubular) comprising an oxidant supply passage, a cathode electrode disposed in the oxidant supply passage, a fuel supply passage, an anode electrode disposed in the fuel supply passage, and a stabilized bismuth oxide oxygen ion conductive ceramic (electrolyte) interposed between the cathode electrode and the anode electrode (see abstract). The oxygen ion conductive ceramic may be arranged to define a plurality of oxidant supply passages and a plurality of fuel supply passages. The oxidant supply passages may be oriented substantially parallel to the fuel supply passages and selected ones of the oxidant supply passages are preferably defined so as to be adjacent to corresponding ones of the fuel supply passages. More specifically, the oxygen ion conductive ceramic may be arranged to define a plurality of substantially parallel longitudinal channels and selected ones of the longitudinal channels may define the oxidant supply passages and remaining ones of the longitudinal channels define the fuel supply passages (col. 2, lines 49-60). The cathode electrode is disposed in the oxidant supply passages and the anode electrode is disposed in the fuel supply passages

Art Unit: 1745

(col. 2, lines 8-15). However, Lawless does not teach each of the gas diffusion electrodes comprise a plurality of layers of material stacked in the axial direction to completely define gas passages having a non-uniform diameter. Furthermore, Lawless teaches an insert 25 is arranged in the gas passages to create turbulence.

The prior art teaches disrupting a laminar flow of gas through a gas passage to create a turbulent flow of gas. Dong 6,663,997 teaches incorporating obstacles in the channels of an oxidant flow field to change a laminar flow to a turbulent flow. However, the obstacles are incorporated into the separator/flow plates. One of skill in the art would not have been motivated to incorporate the obstacles of Dong into the gas passages completely defined by the diffusion electrodes of the claimed invention because the obstacles would reduce the reaction surface area of the electrodes and, therefore, lower the efficiency of the fuel cell. Ishihara 5,209,989 teaches a solid oxide tubular fuel cell wherein laminar flow of a fuel gas is disrupted to create a turbulent flow of the fuel gas. However, as shown in Figure 11, the fuel gas flow passage is not completely formed by the fuel electrode 3, but is partially formed by a tapered tube 1. Therefore, Ishihara does not teach or suggest the claimed invention.

The prior art does not teach a tubular fuel cell wherein each of the gas diffusion electrodes comprise a plurality of layers of material stacked in the axial direction to completely define gas passages having a non-uniform diameter. Specifically, turbulent flow created solely by a gas diffusion electrode layer is not taught by the prior art. The non-uniform diameter of the gas passages completely formed by the gas diffusion electrodes is created by the plurality of layers of material stacked in the axial direction. The prior art does not teach stacking a plurality

Art Unit: 1745

of layers of material in the axial direction to form gas diffusion electrodes completely defining gas passage of non-uniform diameter.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tracy Dove whose telephone number is 571-272-1285. The examiner can normally be reached on Monday-Thursday (9:00-7:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Tracy Dove  
Patent Examiner  
Technology Center 1700  
Art Unit 1745  
January 5, 2005